PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 62731A	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/US 03/35900	International filing date *(day/month/year)* 12.11.2003	Priority date *(day/month/year)* 25.11.2002
International Patent Classification (IPC) or both national classification and IPC C07C37/84		
Applicant DOW GLOBAL TECHNOLOGIES INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 2 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
08.06.2004	10.03.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Breimaier, W Telephone No. +49 89 2399-8327

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/US 03/35900

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-12 as originally filed

Claims, Numbers

1-14 received on 18.02.2005 with letter of 15.02.2005

Drawings, Sheets

1/2-2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-14
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-14
Industrial applicability (IA)	Yes:	Claims	1-14
	No:	Claims	

2. Citations and explanations

   see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

Reference is made to the following documents:
D1: US-A 5 512 700
D2: EP-A 0 558 214

The present application concerns a process for purifying crude bisphenol-A by crystallisation according to claims 1 to 14.

novelty

The subject-matter according to claims 1 to 14 is novel in the sense of Art. 33 (2) PCT.

D1 which is considered to represent the closest state of the art describes a purification process of bisphenol-A wherein crystalline bisphenol-A is obtained from a cooled mixture of the bisphenol-rich organic phase and water in high yields and purity (see column 7, example) rather than by phenol bisphenol-A adduct crystallisation as claimed in step d) according to claim 1 of the invention.
D2 describes phenol bisphenol-A adduct crystallisation of the bisphenol-A purge stream as means in order to obtain crystalline bisphenol-A in high yields and purity (see example, column 2, a.-e., column 3, lines 17-47).
Methods for purifying bisphenol-A using isomerisation steps are known from EP-A 0 630 878 (see example 1, figure 1) and US-A 4 375 567 (see column 3, lines 13-64, figure).
Thus, novelty of the subject-matter as claimed is given.

inventive step

The subject-matter according to claims 1 to 14 seems not to be based on an inventive step in the sense of Art. 33 (3) PCT.

In the light of document D1, the problem posed is the provision of an **alternative** method for making purified bisphenol-A in high yields and purity. This is solved by the crystallisation method according to claim 1, steps a) to e) (see also the figures). In the example phenol bisphenol-A adduct crystallisation (step d) and ismerisation of the mother liquor of this crystallisation step has been carried out (claim 4).

From D2 phenol bisphenol-A adduct crystallisation is known as a means for making

bisphenol-A with improved quality (see the whole document). In addition, EP-A 0 630 878 and US-A 4 375 567 (cited on present page 8) teach that the recovery rate of purified bisphenol-A can be drastically increased by isomerising the mother liquor (see column 5, lines 24-29 and 49-56 and the example). Thus, the present solution, namely to treat the separated bisphenol-A rich phase with phenol rather than with water (see D1, step 5)) and to preferably add further isomerisation steps as taught in the above cited EP documents, in order to provide an alternative method for making purified bisphenol-A is considered to be obvious to the skilled person not requiring any inventive skill.

In the case the object of the present invention is seen in the provision of an **improved** purification process vis-à-vis D1, it is noted that said improvement has not been shown yet. According to D1 column 7, lines 58 to 65 it is said that bisphenol-A is obtainable in 82-95% and of at least 99.7% purity; in the example the yield is 89%. These results are merely confirmed rather than impoved by the present purification method (cf page 8, lines 23-29 and the example). Thus, in the absence of an improved effect, inventiveness cannot be given.

further remarks

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the document D2 is not mentioned in the description, nor is this document identified therein.

The description is not exactly adapted to the claims.

WHAT IS CLAIMED IS:

1. A process for purifying bisphenol-A comprising the steps of

a) cooling a liquid mixture comprising bisphenol-A and water in a bisphenol-A crystallizer to form bisphenol-A crystals in a liquid phase;

b) separating the bisphenol-A crystals from the liquid phase;

c) dividing at least a portion of the liquid phase into a bisphenol-rich organic phase and a water-rich phase;

d) feeding phenol and at least a portion of the bisphenol-rich organic phase into an adduct crystallizer to form a crystalline adduct of phenol and bisphenol-A in a mother liquor; and

e) separating the crystalline adduct from the mother liquor.

2. The process of Claim 1 wherein at least a portion of the mother liquor obtained in step e) is recycled to step d).

3. The process of Claim 2 wherein the mother liquor is subjected to a distillation step to remove water before the mother is recycled to step d).

4. The process of Claim 1 comprising the additional steps of

f) subjecting at least a portion of the mother liquor obtained in step e) to a distillation step to remove water;

g) contacting mother liquor from which water has been removed with a catalyst for isomerizing isomers of bisphenol-A to bisphenol-A; and

h) recycling at least a portion of the mother liquor treated in step g) to step d).

5. The process of Claim 1 comprising the additional steps of

g) contacting at least a portion of the mother liquor obtained in step e) with a catalyst for isomerizing isomers of bisphenol-A to bisphenol-A; and

h) recycling at least a portion of the mother liquor treated in step g) to step d).

6. The process of Claim 1 wherein the crystalline adduct obtained in step e) is washed with phenol.

7. The process of Claim 6 wherein at least a portion of the phenol that has been used for washing the crystalline adduct is recycled to step d).

8. The process of Claim 7 wherein at least a portion of the phenol that has been used for washing the crystalline adduct is first subjected to a distillation step to remove water and then recycled to step d).

9. The process of Claim 6 wherein at least a portion of the phenol that has been used for washing the crystalline adduct and at least a portion of the mother liquor obtained in step e) are combined to a recycle liquor and recycled to step d).

10. The process of Claim 9 wherein the recycle liquor is subjected to a distillation step to remove water before the recycle liquor is recycled to step d).

11. The process of Claim 10 wherein after the distillation step the recycle liquor is contacted with a catalyst for isomerizing isomers of bisphenol-A to bisphenol-A before the recycle liquor is recycled to step d).

12. The process of claim 4, 5 or 11 wherein the catalyst for isomerizing isomers of bisphenol-A to bisphenol-A is a cation exchange resin in acid form.

13. The process of any one of Claims 1 to 12 wherein the bisphenol-A crystals which have been separated from the liquid phase in step b) are melted, mixed with water, cooled in a second bisphenol-A crystallizer to form bisphenol-A crystals in a liquid phase and the crystals are separated from the liquid phase.

14. The process of any one of Claims 1 to 13 wherein crystalline adduct obtained in step d) is subjected to a distillation step to distill off phenol and the resulting bisphenol-A is recycled to step a).

15. Purified bisphenol-A producible according to the process of any one of Claims 1 to 14.